Title: Using Asynchronous, Web-based, Video to Humanize Distance Education

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Project Overview

The goal of our research is to humanize web-delivered, asynchronous, distance education. We believe that our Sync-O-Matic software that delivers streaming video synchronized with PowerPoint slides preserves a human component of instruction. However, it is a one-way delivery system. We propose to develop an infrastructure to support student-initiated audio and video interaction. We expect to create an environment for improved interaction among students and with the instructor.

We have achieved:

- developed and deployed a video, lecture delivery system over the web
- disseminated the software and training for the software over the web
- used the software in two introductory-level classes at MSU: EGR124, CPS230 (CS1)

We propose to

- provide video capture for students in EGR124 and CPS230
- develop two-way, asynchronous video interaction with students
- provide software training at FIE workshops
- disseminate our software on the web
- evaluate the effectiveness of our software
- augment existing asynchronous communication tools with the ability to transition between synchronous and asynchronous communication seamlessly

We will consider our research to be successful if

- asynchronous, web-based distance education can retain sufficient human interaction to be satisfactory to the student and instructor
- many institutions adopt our software and methodology
- students perform no worse on the web than in a standard classroom setting.

We believe that the Internet promises to provide educational opportunities to distance-education students. If we can make it effective, the service those students receive will be enhanced.

Some of our software-development principles are worth noting

- We are developing software that is accessible to everyone.
- We expect this software will be a prototype to be later developed into the ultimate solution that will have a national impact by some commercial source.
- We have an industrial partner to facilitate distribution.

We will adhere to standards for maximum compatibility – we view the work of IEEE P1384 and IMS as key to the long-term future of the field [IEEE1, IEEE2]

Project Description

Pedagogy

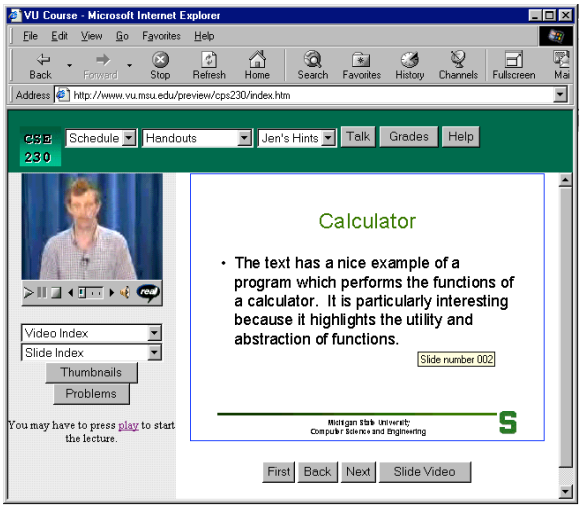
While the primary purpose of this grant is to extend and support existing tools to enhance distance

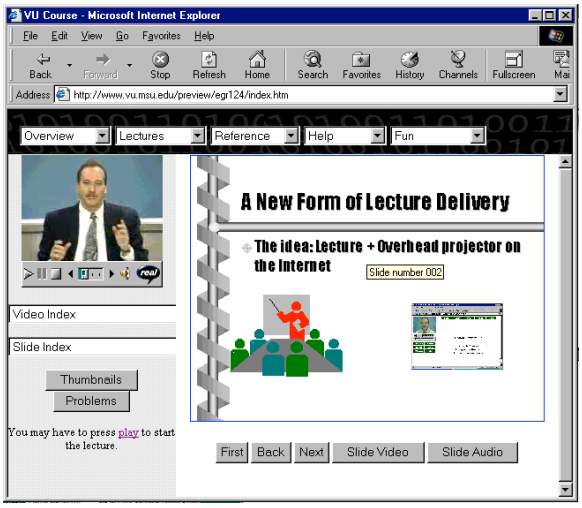
education, it is important to discuss some of the pedagogy behind our approach. Our primary interest is more in teaching using technology than a pure study of the learning process, but we cannot ignore the latter. We have chosen the asynchronous model because we feel that it is the only feasible approach to use when targeting a broad audience especially for distance education. The technical aspects of synchronous video technology are just too difficult for remote students to handle, and the practicality of synchronizing remote locations can be extremely inconvenient especially across time zones. Our experience is that even in the best of circumstances, Internet-based synchronous video is problematic at best. However, the visual aspects of video are critical which is why we are trying to add video elements to the asynchronous model. Interestingly, many proponents of synchronous approaches cite improvements in future networks as evidence that it will eventually be the norm. However, those future networks are all moving toward a quality-of-service model where deterministic latency will cost users while latency-tolerant transfers will be nearly free. If that latency model becomes the norm, synchronous interaction will simply be too expensive for broad deployment and we will still need to learn how to communicate and build relationships effectively asynchronously.

Previous Work

The concept for the Sync-O-Matic 3000 software grew from a desire to effectively deliver lectures over the Web. It began with the merger of RealVideo with PowerPoint. As the instructor talks and flips through slides, the slides are displayed. One sees PowerPoint slides next to a video of the lecture. The two are synchronized so that the slides appear as the lecturer displayed them. In addition, the viewer can select a slide and have the video synchronized to that point. A URL to learn more about this software is http://www.egr.msu.edu/~crs/projects/syncomat/.

The screen capture below shows the RealVideo in the upper left corner with PowerPoint slides on the right. Controls allow one to navigate through the video or the slides; software synchronizes the two. The top screen shows Dr. Enbody teaching CPS230; the bottom screen shows Dr. Severance teaching EGR124.





At MSU this technology is so well developed and integrated that a faculty member can walk into a studio with a floppy containing PowerPoint slides, slip it into a computer, deliver a lecture, and view the lecture on the web by the time she returns to her office. The CPS 230 CS1 course lectures were done that way every week this Fall (1998). This level of integration is possible because the MSU Instructional Television staff have been trained in the use of the Sync-O-Matic software. The interaction with ITV was critical to the development process. Their continuous feedback significantly improved its ease of use.

The student's viewpoint is a lecture that can be viewed anywhere with web access and a 28.8 modem. "Anywhere" has included students in Europe and the Far East.

The development of the Sync-O-Matic software has involved a number of undergraduate students participating in undergraduate research projects.

Because the conceptual framework of the software is easily understood, they can easily contribute to the project. The software is written in Visual Basic V5.0 and is 2500 lines long. We are currently investigating commercialization of the software. If these efforts fail, we will rewrite the software ourselves to expand its availability to Macintosh and UNIX computers.

Two courses at MSU are currently using this web-delivered technology. Both are introductory-level courses and are offered through the Michigan State University's Virtual University. EGR 124 is a course about the Internet, and is taken by students from across the campus and external to the campus. The off-campus students in EGR124 have included high school students and MSU students who spent the summer in Europe and the Far East. CPS 230 is a standard CS1 introduction to computer science course taught in C++. CPS230 is taught in tandem with standard, lecture-based, on-campus sections. These standard sections will be used for comparison of the effectiveness of our approach.

One of the goals of EGR124 has been to involve students in the development and extension of the course. It is done in two ways. First, students give short lectures as a final group project. Each group chooses a topic, develops the lecture material, and then produces them in an on-campus studios. This grant will produce the infrastructure to increase the number and frequency of student-developed material. The URLs for these student lectures are in the references under [STUPROJ]. The other way that students are involved in the class is by producing full-length lectures for subsequent use by the class. The Active Server pages [Pellegrini] and JavaScript [Luchini] were produced by undergraduate students as part of a semester-long independent study project.

In another early attempt to experiment with video to humanize the distance education process, the instructors send "video postcards" to the students from remote locations. The URLs for several video postcards are included in [POST].

Sync-O-Matic 3000 has been deployed and is in use in a number of sites external to MSU. For pointers to some samples outside MSU, see http://www.vu.msu.edu/preview/egr124/refer/other.htm.

This software is not restricted to Computer Science or Engineering in the content it delivers—it can be used in any discipline. It need not be limited to education. Industry can use it for sharing of information or training within a company. A number of industrial sites have expressed interest and have downloaded software, but to our knowledge have not yet deployed it.

Other Projects and Related Work

It is very important in this area of educational software not to keep reinventing the wheel. We spend a significant amount of time studying other approaches and alternatives. Our goal is to teach, not develop software. If we were to find a superior product available either from academic sources or commercially, we would gladly adopt that product. The fact that our current software is a blend of three commercial products (RealVideo, PowerPoint, and web-browsers) indicates our commitment to that principle. In this section, we summarize some the academic and commercial offerings in this area. Space does not allow a comprehensive survey here, but if the reviewers believe we have missed a directly related work, please let us know.

Academic Efforts

There is a wide range of efforts in the web-based and asynchronous learning areas. UIUC is one of the leaders in using non-video asynchronous learning tools. The closest tool to our multi-media approach is:

- Web Lecture System (http://renoir.csc.ncsu.edu/WLS/) at North Carolina State University—This is a very strong offering in roughly the same area. Its core focus is audio-based web lectures and it also stresses the act of recording a standard classroom lecture for live broadcast and later replay. It is a nice system that received funding from NSF for its development.

There is also a number of academic synchronous technologies available including:

- TANGO (http://trurl.npac.syr.edu/tango/) is a synchronous collaboration tool which is extensible
- NCSA also has a number of collaborative teaching tools available

Existing Commercial Efforts

We have looked at commercial systems. They typically have one or more limitations such as requiring a specially licensed plug-in for each student,

or a course management system without visual lectures, or visual lectures without a course management system. Ultimately we are looking for an integrated course delivery and course management system, which works on a broad range of student computing environments. This is a partial list of the systems and software that we have encountered in our search:

- RealPresenter from RealNetworks allows the presentation of a PowerPoint lecture with audio, but it is not integrated into a course management system
- Microsoft NetShow is a web lecture delivery system which surpasses Sync-O-Matic in some feature areas, but it is not portable across a diverse client environment
- Eloquent Software
- Bright Light
- Symposium from Centra Software
- Bamba - from IBM
- Street Technology
- ClassPoint from White Pine Software
- PHOENIX from Pathlore Software

You can reference the hot-links for the above companies at http://www.vu.msu.edu/preview/egr124/refer/comp.htm

Standards Efforts

We plan to make use of standards whenever possible in our software development. Standards are critical for wide adoption and maintenance of software. We are tracking the following standards efforts:

- IEEE P1484 (http://www.manta.ieee.org/p1484/)
- ARIADNE Project (a European standards effort) (http://ariadne.unil.ch/main.htm)
- The Instructional Management System (IMS) project (http://www.imsproject.org/) supported by EDUCAUSE (formerly EDUCOM)

What We Plan to Do

The ultimate goal of the project is to continuously integrate increasing amounts of visual communication into our courses (CPS230 and EGR124) without resorting to a completely synchronous model. The EGR124 (Internet and Technology) course will be used to test the most experimental ideas and software. The CPS230 (C++, CS1) course will insure that these ideas work while teaching more traditional course (a.k.a. "less fun") material. The latter provides a production environment of a technical course that is required for many subsequent courses. We will continue to make much of the material from these the courses available over the web without a password so others can easily study our methods and approaches and learn from them. We encourage reviewers to visit the courses at http://www.vu.msu.edu.

The effort in the grant falls into roughly four areas:

- Support of students' ability to create visual material at a distance. This support includes solving the problem of easy development for their homes, schools, dorm rooms, and on campus. Much of the software exists for video development and is readily downloaded, but its use is very complex. Hardware for video capture is less readily available.

- Modification of existing software to add visual cues throughout all course interaction (student-student and student-instructor) while keeping the bandwidth requirements to a minimum.

- Developing a new widget to give students the opportunity to detect when other students and instructors are on-line and to interact synchronously with them when it is possible (still assuming nothing more than a dial-up connection).

- Integrating these tools into our courses as they become available

We will share our results with others as they are developed (similar to what we are doing currently with Sync-O-Matic) with the ultimate goal to commercialize the innovations as quickly as possible. We believe that commercialization will provide both the widest distribution and the most robust software. In an ideal world, some of the tools that we develop would come from the commercial sector. When that happens we will adopt these tools and focus our effort on improving our courses and studying the results.

Creating Video Material at a Distance

Currently we use RealVideo products because they span multiple operating systems (Window, Macintosh, UNIX, and others). RealNetworks provides a complete set of free tools for encoding and managing streaming network video. These tools are well designed, but getting the hardware and software in

place to use them effectively is a daunting task. We expect to have all of our students producing video material by roughly the third week of the class. To accomplish this, the students need much more than a few URLs and some instructions to download materials.

We already have experience with solving this type of "bootstrap" problem for EGR124. In EGR124 (and CPS230) students must solve a number of technical hurdles before they can participate in the class. These hurdles include:

1. Installing a modem
2. Getting a network connection
3. Activating their e-mail account
4. Putting up their first web page
5. Getting their course password activated
6. Installing the RealPlayer so they can view lecture material properly

To insure that students could accomplish these tasks effectively, we developed a 1.5-hour videotape entitled "Welcome to the Virtual University" which covered all of these topics in complete detail. It was supplemented with paper materials and the availability of an 800-number hotline provided by Michigan State University as part of the Virtual University. In EGR124, the first assignment is tied directly to these learning objectives. It is jokingly called the "Gauntlet". Interestingly, while our purpose in develop materials was to reduce the need to walk each student through the process of getting their technical environment set up, several students have commented that they found the gauntlet to be one of the best learning experiences in their entire college career. We assume that this is because there were clear learning objectives for the work, and that the objectives were actually skills that the student found to be useful. You can look at the video material used for the gauntlet at http://www.vu.msu.edu/preview/egr124/lectures/welc/index.htm.

We hope to use the same model for student initiated video. We will develop thorough materials showing the student how to produce web-delivered video starting from hardware all the way through uploading and viewing their material on the web. For EGR124 this will be integrated into a self-directed activity as part of the Advanced Multimedia lecture.

One potential model is to require EGR124 as a suggested pre-requisite for all web-delivered courses. Students could "place out" of the course by passing an extensive "gauntlet" exam. Because all of the EGR124 course material is on the web, skilled students could study for the "gauntlet" without being registered for the course. Students with a fear of technology could take the EGR124 course to familiarize themselves at a slower pace with more support both from the instructors, teaching assistants, hot line, and other students.

We will also provide students with the necessary hardware (see equipment) so they can produce this material. For on-campus students we will provide a lab with the equipment all set up. For remote students, we will ship them loaner video cameras for use during the course.

Once we have the capability for the students to produce and upload video materials, we will make a very slight extension of the existing MSU Virtual University student profile to allow students to point to their video material from their profile.

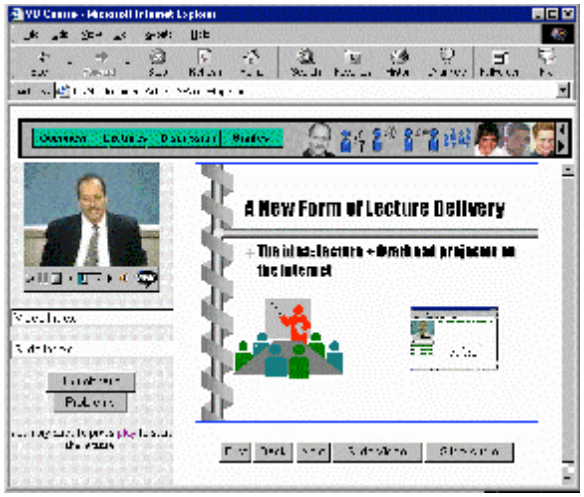
The most significant effort for this work will be the support of the student assistants, and the development and improvement of our support materials as we gain experience in this area.

We expect that we will be using student-produced video in our classes no later than the second semester after the grant is awarded. Throughout the remainder of the grant we will continue to integrate student video into the course work, and evaluate its effectiveness.

Adding Visual Cues to Existing Software

We already use asynchronous communication tools effectively. The goal of this area is to purchase (preferred) or develop an asynchronous discussion system which includes hyperlinked pictures of the participants shown with each comment made by the participants.

Here is a sample of a lecture being viewed using our new interface.



Here is a detailed look at the interface in the upper right corner of the screen.

You can see a larger version of the screen at the end of this document or at http://www.egr.msu.edu/~crs/papers/due1198/indextop.htm.

From left to right, the icons mean the following:

- Instructor is on-line and available for synchronous communications (Click on instructor picture to initiate a conversation)
- Click on the question marks to ask a question (live or asynchronous)
- There are some announcements available
- The icon with two people "talking" indicates that there is an on-going conversation. Click on the icon to join the conversation.
- The group of people indicates that some members of this student's group are currently on-line.
- The pictures on the far right are the other students who are currently on-line in the class. Clicking on any of the pictures initiates an on-line discussion with the pictured student

These elements will dynamically appear as students and conversations join the class and leave it. For example, the following is a version of the bar when absolutely no other student from the class is online.

The student can still ask a question or view the asynchronous chat room and the announcements.

We already use software called WebTalk that was developed at Michigan State University for this type of communication. It is well integrated into the MSU Virtual University environment (student profiles, grading tools, etc). Because we have access to the source code, we will be able to integrate student pictures into the software with a minimum of effort. Ultimately, we hope it will be replaced by an integrated commercial package, at which point we will gladly adopt the commercial package. We hope that our effort can be viewed as a prototype for that ultimate commercial package. In addition to WebTalk we are investigating adding visual clues to MajorCool.

We expect that the augmented version of WebTalk will be developed and deployed for the first semester immediately after the grant is funded.

Synchronous Targets of Opportunity

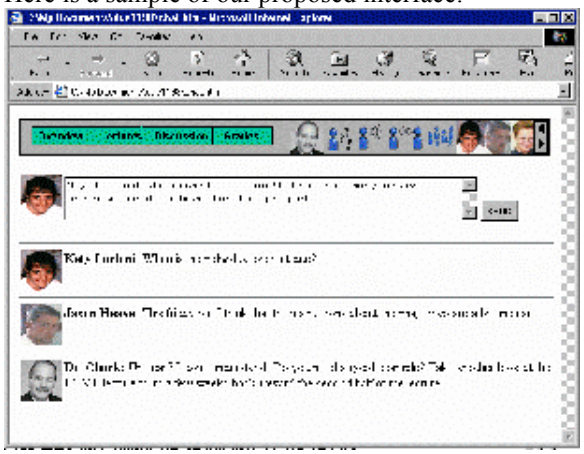
While we do not advocate the "pure-synchronous" approach to web-based distance education, we have found that small amounts of synchronous communication can significantly enhance the student experience. To date, we have use America Online's Instant Messenger, ICQ (I Seek You), and UNIX "talk" for this purpose. Each (with some effort) allows students and instructors to track each other and know when they are on-line. We maintain a "buddy list" so if someone else in the class logs in we get a subtle notification, and have the opportunity for a quick chat.

Currently this approach works for the technically astute students who can install and configure an additional piece of software. However, many of the students who need synchronous interaction the most find it difficult to understand how these software packages are to be installed and used. Furthermore because they are not integrated into the course management software, each student must hand-build the "buddy list" for the entire class. Sadly, the net result of this is that the students typically end up with a buddy list of the instructor and possibly the teaching assistants and seldom add other students in the class to their buddy lists.

Our proposal is to add a basic buddy list capability to our course management software that tracks and subtly notifies the students whether or not other participants in the class are on-line at the same time. It will be a small bar which is visible (and updated) all the time while the student is viewing course materials. Initially it will be a JAVA applet (very small) which maintains a server connection. Once the student sees the visual

cue, they can press a button to immediately start a chat with the other participant. This chat will be done using only the browser. No separate application will be needed (to simplify the use of the software). The chat software will use the same look and feel as the asynchronous communication tool (WebTalk) and the conversations will be logged and made available for later viewing by other students. The goal in our approach is to make the synchronous and asynchronous interactions as seamlessly integrated as possible. We hope to have a facility that allows students to "eavesdrop" on a conversation between the instructor and the student (unless they want a private conversation). If the second student is on-line at the time, the eavesdropping can be live. If the student is 12 time zones away, they can still eavesdrop later using the asynchronous tool.

Here is a sample of our proposed interface:



For a larger version of the screen shot, see the end of the narrative or go to http://www.egr.msu.edu/~crs/papers/due1198/chat.htm.

Again, we hope that this capability will be integrated into a commercial package by the end of this grant. To that end, we will work with companies to commercialize our ideas, using our software as a proof of concept. If and when adequate software is available which is satisfactory, we will convert our classes to that software as soon as practical and move on to other challenges.

Integrating these Tools into Our Courses

The real goal of our work is to teach better courses and to help others develop satisfying distance education courses. You will notice by the timeline that our software development is over about one year into the project. That is because the easy part (as we have designed it) is to produce the software. The hard part is to deploy the software and make good use of the software in our courses. We feel that the best way to make progress at this frontier is to deploy the software, and adjust the software and our use of the software each time our courses are taught (as Nike says, "Just do it!").

EGR124 already has a number of collaborative student assignments in the course. Students collaboratively work on several papers, and produce on-line lectures in a studio as a group project. [STUPROJ] So far, our tools and environment significantly limits our ability to do true collaborative learning among students. With our new infrastructure in place we hope to improve these collaborative activities. Some example ideas include:

- Video introductions of each student
- Individual and group projects which result in a student "presentation" on-line using the Sync-O-Matic software. These assignments will be designed to answer commonly encountered problems in the class. In a sense, we will use the students to develop a comprehensive on-line video FAQ (Frequently Asked Questions) database for future students in the class.
- We hope that the visually augmented asynchronous and synchronous tools will allow us to have students increase their collaboration-at-a-distance capability. By having the ability to observe and participate in the conversations asynchronously, we can learn a significant amount about what works and what does not work with collaboration at a distance.

We are quite confident of the success of the first two points. If we can solve the last challenge, then we will have something that we can be very proud of. By continuously monitoring our success and challenges, we can feed back to our software development team ways to improve the software and feedback to ourselves ways in which the assignments and courses can be improved.

Timetable

Our timetable is very aggressive. Unless commercial software shows up which solves our problems before the project is started, we will quickly extend our existing environment as described above. We expect to deploy much of the software in the first semester after the grant is awarded, and the remaining software by the second semester after the grant is awarded. We

have complete designs in place that will allow us to meet this demanding schedule.

The remaining time will be spent integrating the tools and developing the courses.

We expect to participate in technology transfer to commercialize these ideas from the very beginning of the effort. Also, we will be disseminating these ideas as an ongoing activity throughout the project.

Facilities and Resources

Michigan State University is the ideal location to pursue this project for the following reasons:

- MSU has an active Virtual University project (http://www.vu.msu.edu/) which started in the fall of 1996 and currently has nearly 30 technology-enhanced courses. This effort is supported across the entire university out of the office of the Vice-Provost for Computing and Technology. The virtual university provides staff and computing resources to the instructors of VU courses at no charge. Much of the software we are proposing to extend was developed in this group. We plan to give our enhancements back to the group so other courses can take advantage of our innovations.
- MSU is a land-grant university with a strong outreach program throughout the state of Michigan. Through our Vice Provost for Outreach, (www.msu.edu/unit/outreach) we have remote computing facilities at four locations around the state of Michigan where we can deploy technology, give exams, and provide student support. Because of a strong College of Education, we have excellent relationships with K-12 schools around the state. Through both of these relationships we have involved an increasing number of high school students taking our web-based classes for college credit.
- MSU's Instructional Television (www.wkar.msu.edu) capabilities are state-of-the art. Like many of the leading distance education universities, MSU has been heavily using television technology to support distance education since the 1960's. It also helps to have a top-ten communications arts/television and radio program and full-fledged PBS Television, AM, and FM stations on campus. Colleagues often tell us from other institutions just how lucky we are to have the kind of technological support available to us (at no charge) for credit-based education.
- MSU has a goal of involving 40% of the students in at least one semester of education at some location outside the United States (the Engineering College's goal is 60%). We already have a number of successful programs around the world. The technology we are developing will allow those students to take classes from an MSU instructor regardless of their location. These distance classes can be used to fill out a student's schedule when there are not sufficient locally available local courses.

Our success to date in this area is due in a large part to this infrastructure and support available at Michigan State University.

College of Engineering

In addition to the supportive university environment, the College of Engineering provides unique resources to make this effort a success. One of the PI's on the grant is the Director of Computing for the College and is responsible for a number of areas of the College's technology including: 250 seats of open lab computer seats, both PC and UNIX, a consulting office for students and faculty, the building network infrastructure, supporting the faculty computing environment and supporting administrative computing needs. It is the ideal position from which to support web based distance education for the college. The unit has one 50% time employee currently working in this area and we hope to increase the effort directed at this area. The Computer Science department also has its own support organization with 120 seats of PC and UNIX computing available on a 7day/24hour basis.

There are two state-of-the art television studios in the Engineering building staffed by ITV personnel. Recently, all of the ITV studios have been given sufficient equipment to do real-time encoding and delivery of web-based lectures.

Also, the College of Engineering is making strong strides into global teaming and global design activities. Because the equipment purchased in this grant will be made available to the general engineering student and faculty population, it will enhance the ability for students working in these global activities to engage in video interaction.

The College recently went through an ABET Criteria-2000 accreditation, so we have excellent processes in place to evaluate and improve our courses and curricula. We have several efforts under way funded

by Ford Motor Company and the GE Educational fund to reform our undergraduate curricula. Both CPS230 and EGR124 are closely aligned with those efforts.

Equipment

The equipment being requested in this grant falls into three categories:

- Additional PC seats to be used for video capture and delivery. Currently the college supports over 100 PC systems, but less than 15 are powerful enough to support the needs of this project. The plan is to expand the seats that can be used for video digitization sufficient for the needs of our courses. At times, we will reserve these systems for use in our web-based classes. The systems will be available for all faculty and staff in the college at all other times, especially for other web-based courses.
- Video cameras for use with the new computer systems and existing computer systems. These cameras will be available to any student or faculty member by checking them out from the Engineering consulting office. Some cameras will be loaned to remote students taking CPS230 and EGR124 classes. The cameras will use the USB (Uniform Serial Bus), so they can be moved from one system to another with a minimum of effort.
- We will purchase portable computers for several purposes (1) use by remote students and (2) for use when we give workshops and presentations on our technology.
- We also will install at least one system with a camera in each of the (4) MSU remote offices around the state, if those offices do not already have sufficient equipment to digitize student video.

The budget for equipment for the project breaks down as follows:

#	Description	Unit	Cost
18	Desktop Computers, Video capable	$2000	$36000
30	Portable Video Cameras	$100	$3000
3	Portable Computers, Video capable	$3000	$9000
		Total:	$48000

With this plan, we make good use of existing resources, and add resources sufficient to support our increased use of the computing facilities. Our approach maximizes the possibility that collateral benefits will occur. The Division of Engineering Computing Services as part of its regular operations will assume the ongoing support of the equipment once purchased.

After the Grant is Finished

Much of the design of the project insures that support will continue after the grant period is over. For the on-campus hardware and equipment, the College of Engineering will support it. We will need to seek additional funding if we wish to continue to "loan" equipment to high school and other remote students taking our classes. Perhaps by then video capture will be much more readily available and it will cease to be an issue.

The software is already an on-going work on the part of the PI's—it will continue. The grant will accelerate our work. In the short term, we will share our innovations with the Virtual University at MSU. In the long term, we are working closely with our commercial partner(s) to see that these features are integrated into some upcoming commercial offering.

The work of becoming better teachers is never finished.

Evaluation

The primary goal of this effort is to develop and deploy asynchronous video capabilities in our courses. Knowing we are pushing the leading edge of lecture delivery makes us very aware of the limitations of our courses. We continuously monitor the health of our courses through various student feedback mechanisms ranging from simple survey instruments which are given for each lecture to focus groups with the students. There are so many areas for improvement in these courses that we do not wait for long-term scientific research results before we apply changes to these courses.

We have a number of interesting studies that could be performed using our courses such as:

- Comparing the web to non-web sections of CPS230. Because both sections will operate for at least two years, we will have a good opportunity to study the effect of the class. Because all of the sections are so oversubscribed, the makeup of the web and non-web sections is nearly random. We plan to do a longitudinal study of the students' performance on succeeding coursework based on which CPS230 section they took.

- For EGR124, we can do surveys from semester to semester as new innovations are rolled out. We will primarily examine how student collaboration can be enhanced using these tools.

We understand that there is a difference between gathering information primarily for the improvement of a course and performing publication quality educational research. We feel that we will be quite capable of performing internal analysis for the improvements of our course. We have more to learn on how to do true learning research—we are looking for help in this area and have already initiated collaboration with the MSU College of Education (one joint Ph.D. is already in progress with EGR124 as its topic). We also intend possible collaboration with the SCALE project at University of Illinois at Urbana Champaign.

Dissemination

Given that one of our metrics for success in this project is the adoption of these approaches at other institutions, dissemination is an important part of our effort. We hope to do it through the following efforts:

- Software, documentation and training available on the world-wide-web (our current software is downloaded several times per week).
- Our courses will be put up on the web as demonstration sites for our approach.
- We will write and present our work at various conferences, and, to the extent possible, in journals and other publications.
- We will hold workshops showing how to use our software and approach (A workshop at Frontiers in Education 1999 is already planned).
- We will visit and give invited talks and consult with other educational institutions interested in our technology.

We have a significant track record in disseminating our current work. The following are some of the efforts that have been done during 1998 relating to the Sync-O-Matic software.

- ASEE 1998 North Central Region Conference – Paper and workshop
- University of Delaware – Visit and consulting
- IEEE P1384 Standards meeting – Demonstration
- University of Wisconsin – Consulting
- Santa Anna Community College – Talk and demonstration
- University of California Berkeley – Talk and demonstration
- Apple Computer Corporation – Talk and demonstration
- Sun Microsystems – Talk and demonstration
- ACM SIGCse in Ireland – Demonstration session
- University of Illinois Urbana-Champaign (SCALE Group) – Talk and demonstration
- IEEE Southeastern Michigan Section Fall section meeting– Talk and demonstration
- University of Michigan – Talk and demonstration
- Frontiers in Education – Informal demonstrations

We are very excited and proud of our current technology. Most people who see it are amazed that we can produce a lecture in seconds using only a portable computer and give it to them on a floppy. The pedagogical value of asynchronous video needs more study, but most people who are actually teaching using the web believe that adding video to their courses would be a significant improvement. With this grant, we hope to show them the next innovation for their courses.

Beyond this Grant

We have a significant number of further improvements in the area of web-delivered education that requires more effort than can be supported in the budgetary constraints of this grant. We hope to apply for additional funding or see these ideas developed through our commercial ties or other grant supported work. Some areas of these ideas include:

- Synchronized whiteboard in addition to the synchronized PowerPoint
- Synchronized demonstration of working software similar to an asynchronous version of Microsoft NetMeeting
- Integration of active learning components into lectures
- Significant improvement of quiz/homework maintenance with item analysis, student feedback on question quality
- Development of learner and instructor models to help personalize the educational process

We expect that the solutions to these problems may come from others or from the commercial domain. Some day we will have amazing commercial software that provides a talented teacher a framework in which to operate. Sadly that is not yet the case.

Conclusion

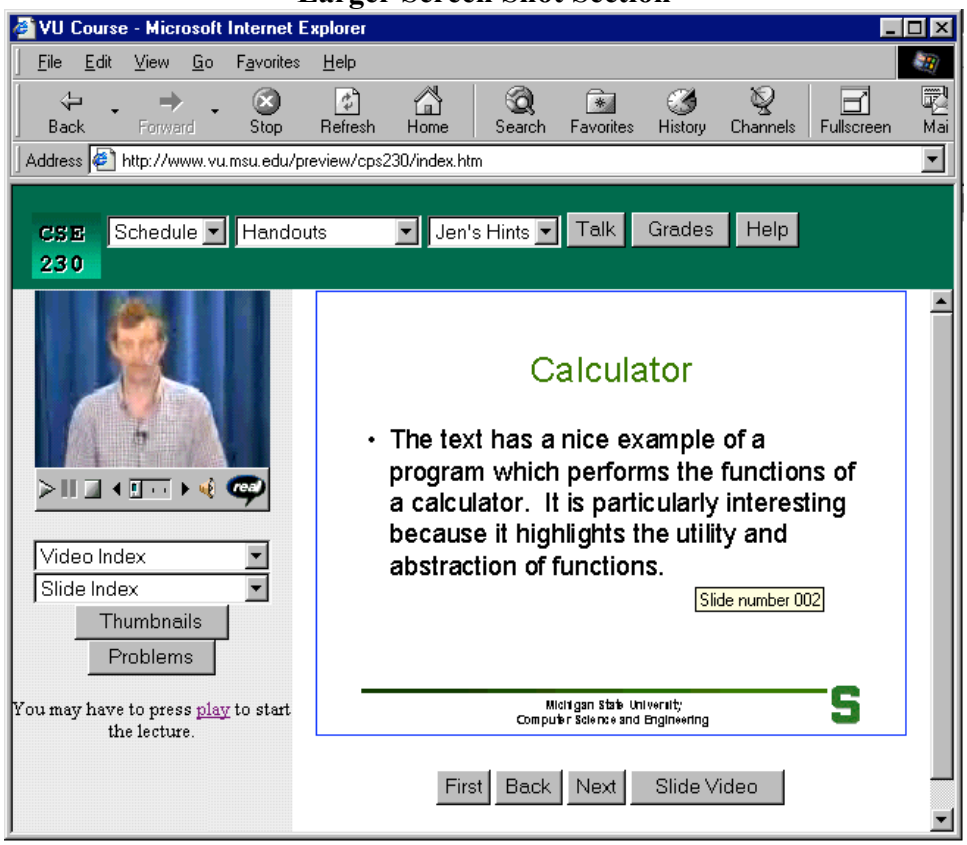
It seems that everyone in the educational technology field is racing toward the same “holy grail”. That Holy

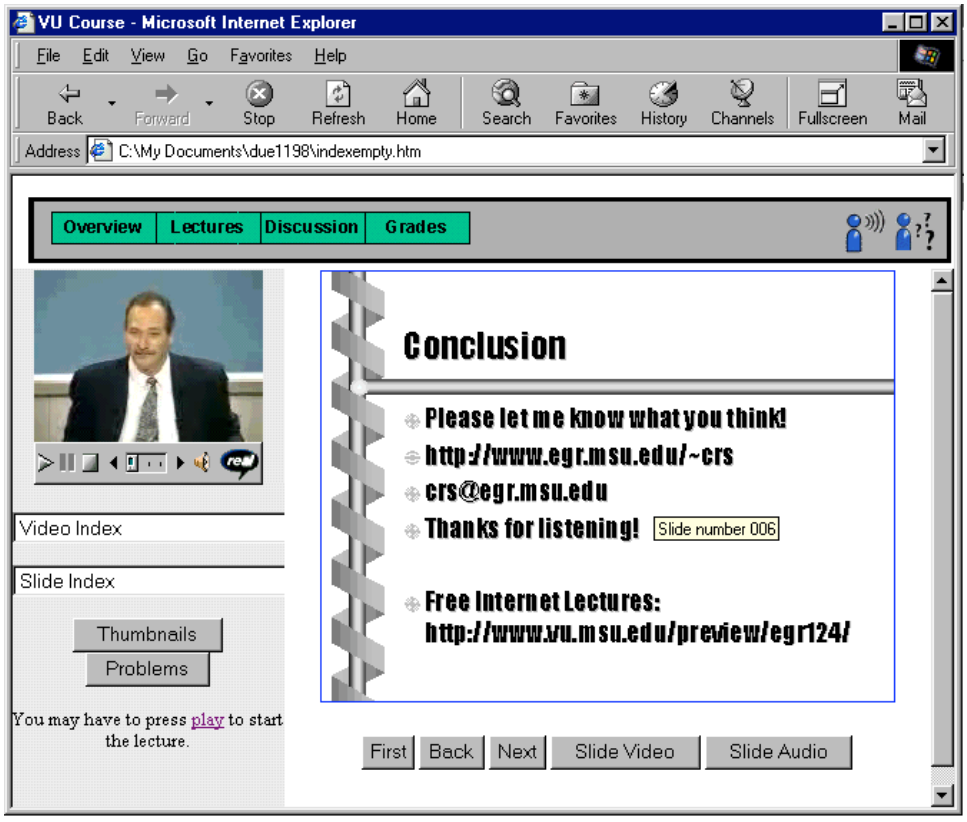
Grail is a robust, web-based educational experience that can be delivered at a distance. While different groups are going toward the same destination, we seem to be starting from very diverse locations such as:

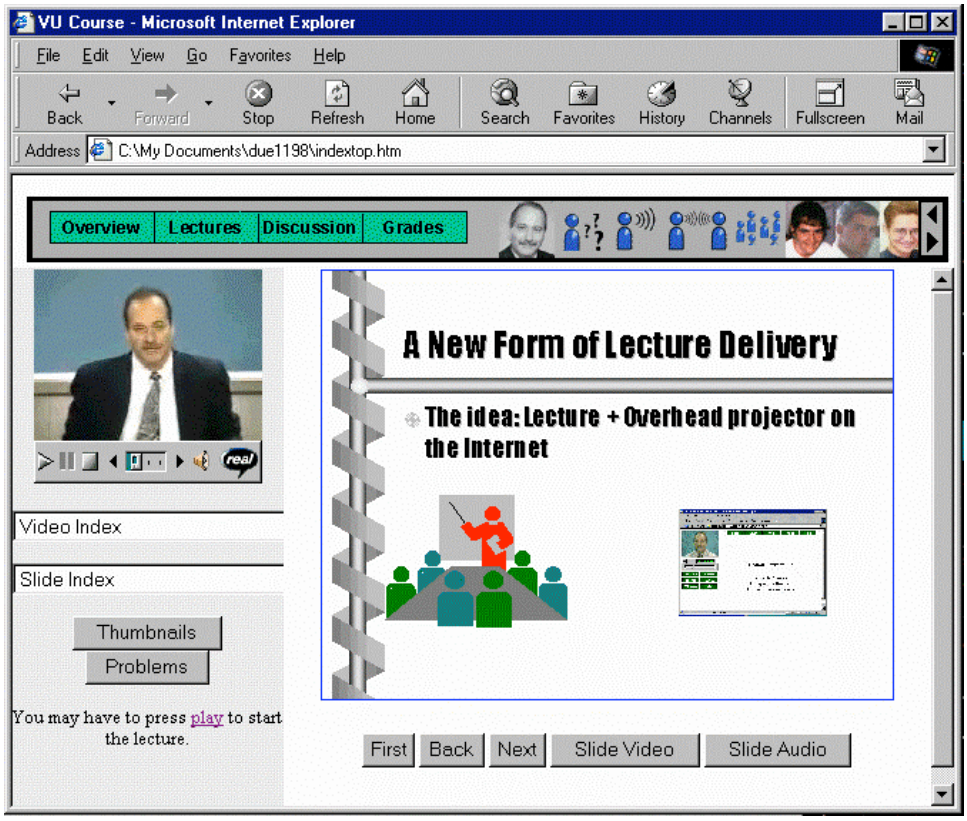
- Use simple tools to encourage lots of asynchronous communization so students learn through communicating with their peers and the instructors
- Put up a book on the web and augment it with lecture materials and self-motivated exercises and even sometimes multimedia snippets. This is the ultimate "correspondence" course and is successfully used at many institutions.
- Spend significant money to provide dedicated synchronous video connections or satellite delivery
- Distribute video tapes and a workbook for the students
- Develop interactive learning experiences such as simulations which help the students
- Deliver web renditions of lectures to the students to simulate a traditional classroom environment

We believe that the true revolution in web-based education will occur once we have developed all of these approaches to a fine point, and then we begin to share our tools and techniques to produce hybrid courses that blend all of these techniques.

Larger Screen Shot Section



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Overview Lectures Discussion Grades
A New Form of Lecture Delivery
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Thumbnails
Problems
You may have to press play to start the lecture.
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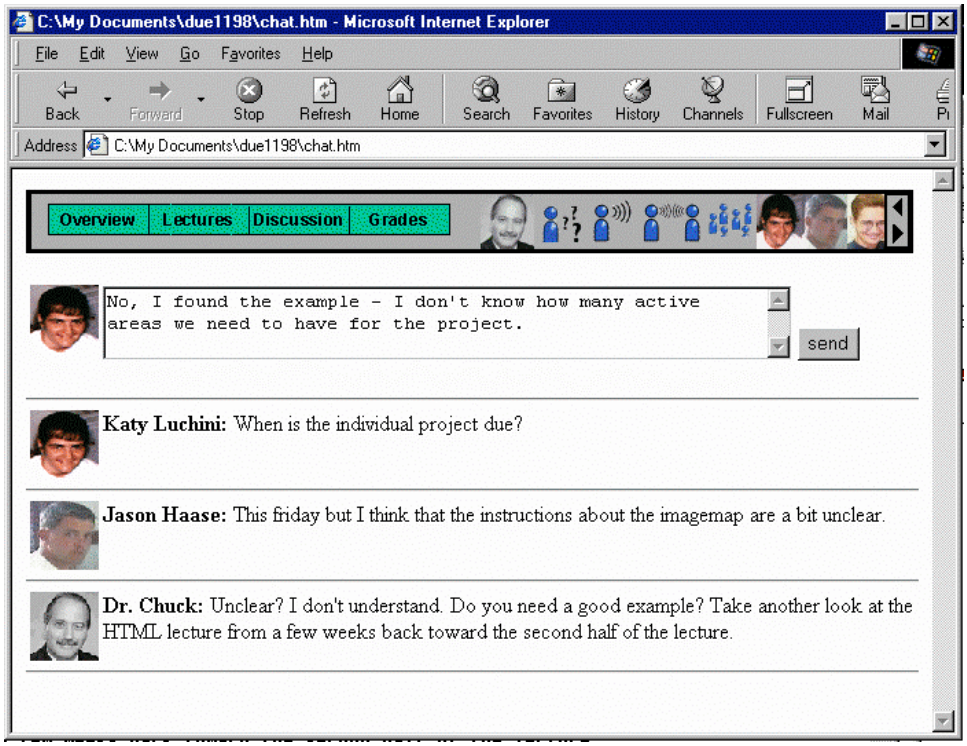
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Overview Lectures Discussion Grades
No, I found the example - I don't know how many active areas we need to have for the project.
send
Katy Luchini: When is the individual project due?
Jason Haase: This friday but I think that the instructions about the imagemap are a bit unclear.
Dr. Chuck: Unclear? I don't understand. Do you need a good example? Take another look at the HTML lecture from a few weeks back toward the second half of the lecture.

References Cited

[IEEE1] Resmer, M., "Internet Architectures for Learning", IEEE Computer September 1998, pp. 105-106.

[IEEE2] Schoening, et al., "Standards-The Key to Education Reform", IEEE Computer, March 1997, pp. 116-117.

[STUPROJ] Student Projects, EGR124 Spring and Summer Semesters 1998
http://www.vu.msu.edu/preview/egr124/lectures/groups98.htm and
http://www.vu.msu.edu/preview/egr124/lectures/groupu98.htm

[Luchini] Luchini, K., A lecture on Javascript, Independent Study
http://www.vu.msu.edu/preview/egr124/lectures/jscr/vf001.htm.

[Pellegrini] Pellegrini, N., A lecture on Active Server Pages, Independent study,
http://www.vu.msu.edu/preview/egr124/lectures/asp/vf001.htm.

[POST] Video Postcards from the instructors.
http://www.vu.msu.edu/preview/cps230/lectures/msg/enbody1198.ram
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